Armed Forces College of Medicine

AFCM

Clinical Assessment of the Endocrine System

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Indented Learning Outcomes (ILOs)

- By the end of this lecture the student will be able to:

1. Define terms in endocrine system
2. Describe function and control of endocrine system
3. List the common symptoms and signs attributed to endocrine system disorder

Endocrine system

- **Endocrine system** (ES): includes the nervous system and the interconnected network of glands
- A key feature of all endocrine glands (EG) is the secretion of **hormones**
- **Hormones** are biochemicals that exert their effect on **target tissues**
- **Target tissues** (TT): usually located some distance from the endocrine gland, with no direct physical connection between EG and TT

Endocrine system

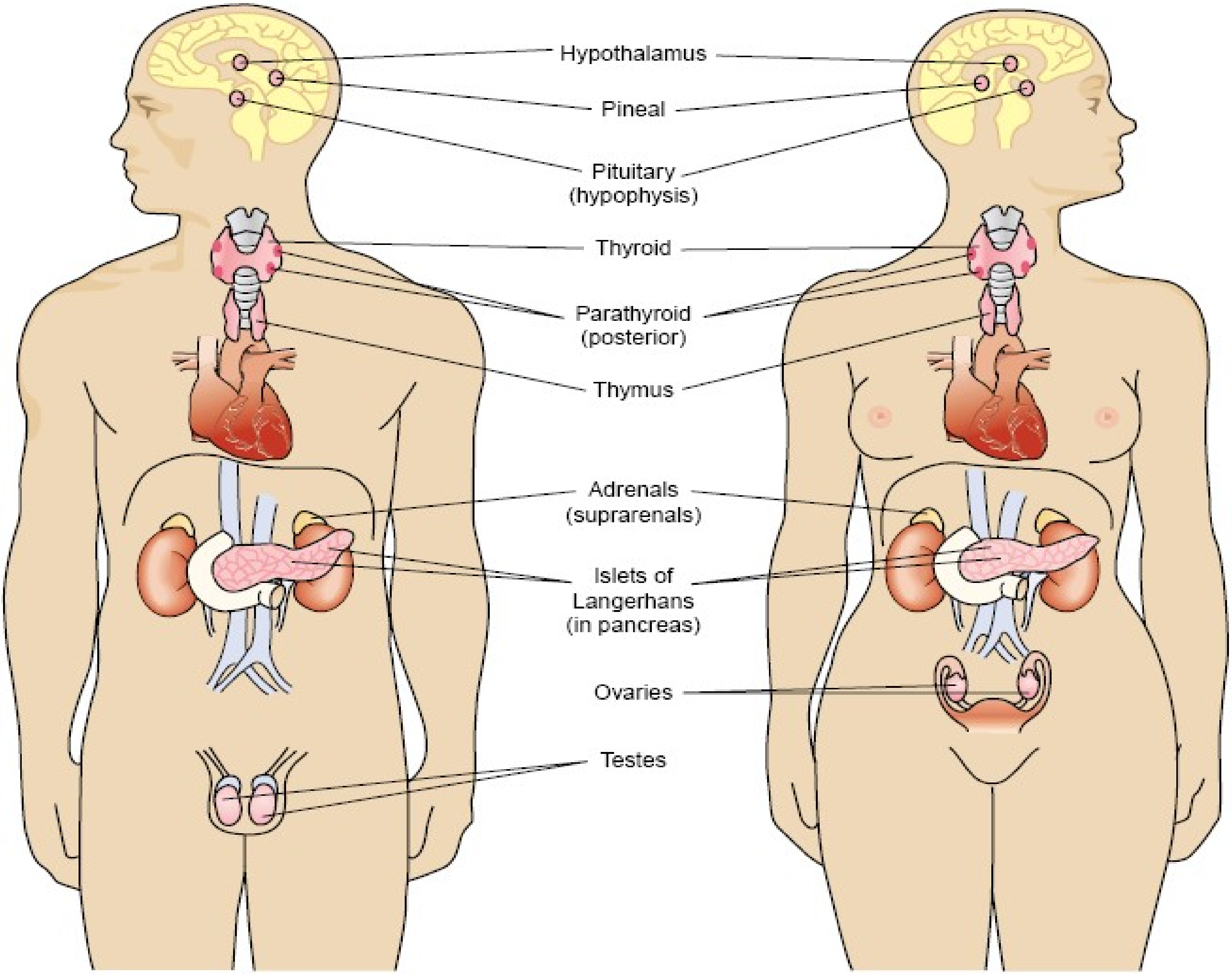
- For this reason EG are called “ductless” glands and must use circulatory system to transport secreted hormones to the TT
- EG include the following:
    - Pituitary gland
    - Adrenal glands
    - Thyroid gland
    - Islet cells of the pancreas
    - Parathyroid glands
    - Gonads

Endocrine system

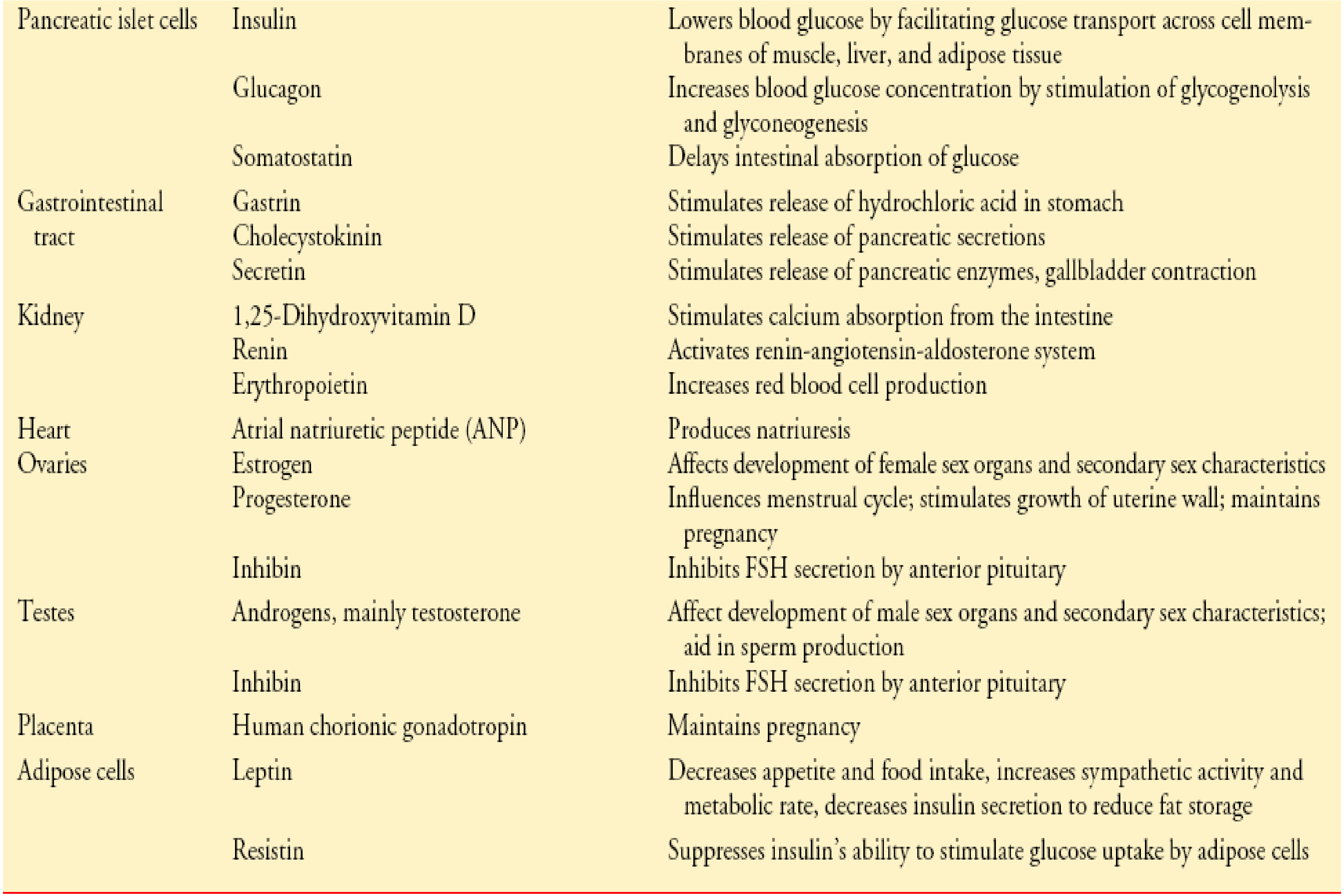
- The endocrine system works with the nervous system to regulate overall physiologic function – **neuroendocrine regulation**
- The ES keeps the constant normal balance (**homeostasis**) of the organs and systems in response to environmental changes

Endocrine system

- **Hormones**:
  - Steroid: eg; hydrocortisone
  - Peptide (protein): eg; insulin
  - Amine: eg; epinephrine
- **Negative feedback control mechanisms**
  - In the healthy physiologic state, hormone concentration in the bloodstream is maintained at a relatively constant level
  - When the hormone concentration rises, further production of that hormone is inhibited
  - When the hormone concentration falls, the rate of production of that hormone increases

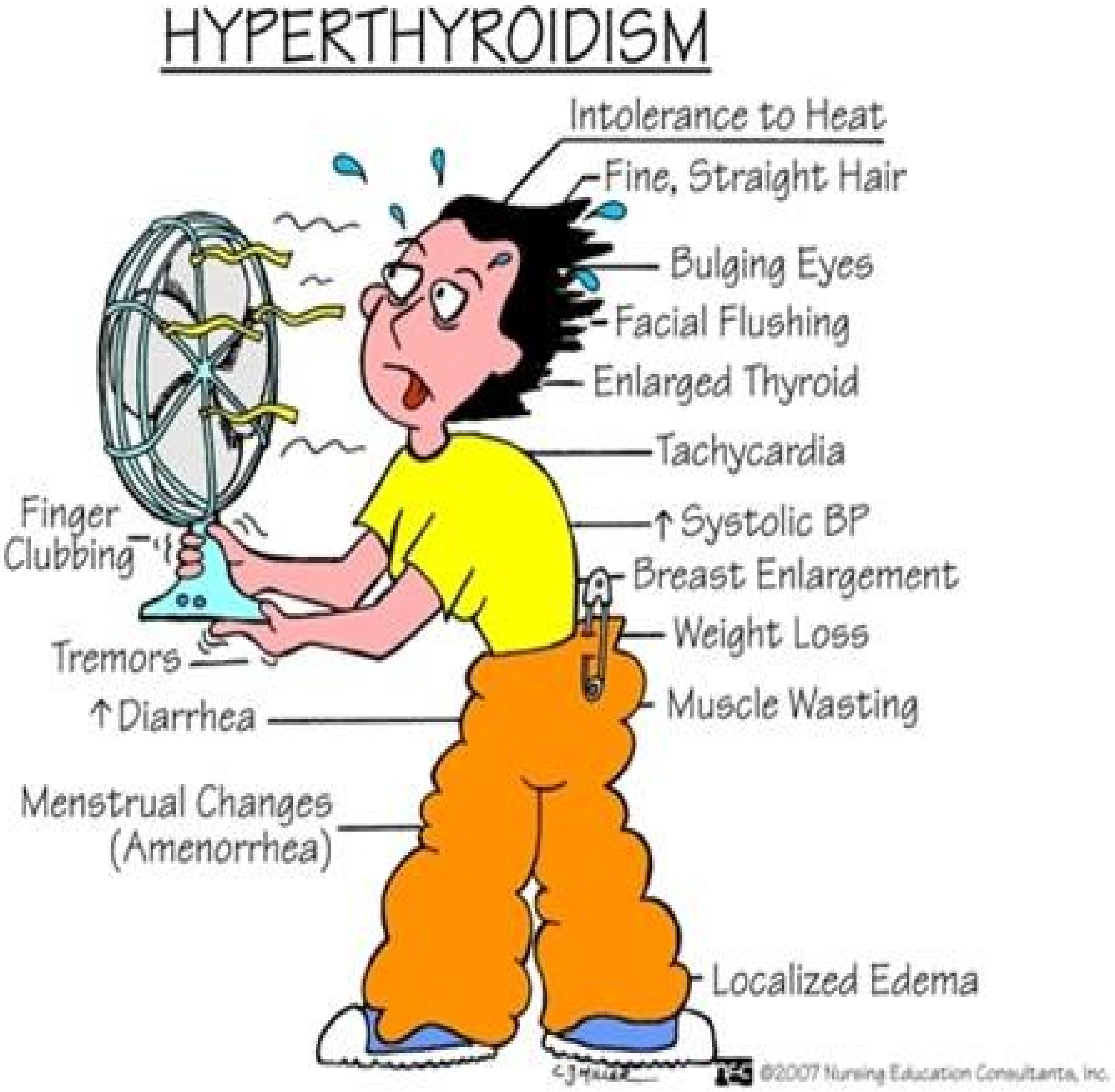

Hypothalamus
Pineal
Pituitary (hypophysis)
Thyroid
Parathyroid (posterior)
Thymus
Adrenals (suprarenals)
Islets of Langerhans (in pancreas)
Ovaries
Testes

SOURCE	HORMONE	MAJOR ACTION
Hypothalamus	Releasing and inhibiting hormones Corticotropin-releasing hormone (CRH) Thyrotropin-releasing hormone (TRH) Growth hormone-releasing hormone (GHRH) Gonadotropin-releasing hormone (GnRH)	Controls the release of pituitary hormones
Anterior pituitary	Growth hormone (GH)	Stimulates growth of bone and muscle, promotes protein synthesis and fat metabolism, decreases carbohydrate metabolism
	Adrenocorticotropic hormone (ACTH)	Stimulates synthesis and secretion of adrenal cortical hormones
	Thyroid-stimulating hormone (TSH)	Stimulates synthesis and secretion of thyroid hormone
	Follicle-stimulating hormone (FSH)	Female: stimulates growth of ovarian follicle, ovulation Male: stimulates sperm production
	Luteinizing hormone (LH)	Female: stimulates development of corpus luteum, release of oocyte, production of estrogen and progesterone Male: stimulates secretion of testosterone, development of interstitial tissue of testes
Posterior pituitary	Antidiuretic hormone (ADH)	Increases water reabsorption by kidney
	Oxytocin	Stimulates contraction of pregnant uterus, milk ejection from breasts after childbirth
Adrenal cortex	Mineralocorticosteroids, mainly aldosterone	Increases sodium absorption, potassium loss by kidney
	Glucocorticoids, mainly cortisol	Affects metabolism of all nutrients; regulates blood glucose levels, affects growth, has anti-inflammatory action, and decreases effects of stress
	Adrenal androgens, mainly dehydroepiandrosterone (DHEA) and androstenedione	Have minimal intrinsic androgenic activity; they are converted to testosterone and dihydrotestosterone in the periphery
Adrenal medulla	Epinephrine Norepinephrine	Serve as neurotransmitters for the sympathetic nervous system
Thyroid (follicular cells)	Thyroid hormones: triiodothyronine (T_3), thyroxine (T_4)	Increase the metabolic rate; increase protein and bone turnover; increase responsiveness to catecholamines; necessary for fetal and infant growth and development
Thyroid C cells	Calcitonin	Lowers blood calcium and phosphate levels
Parathyroid glands	Parathyroid hormone	Regulates serum calcium



Pancreatic islet cells	Insulin	Lowers blood glucose by facilitating glucose transport across cell membranes of muscle, liver, and adipose tissue
	Glucagon	Increases blood glucose concentration by stimulation of glycogenolysis and glyconeogenesis
	Somatostatin	Delays intestinal absorption of glucose
Gastrointestinal tract	Gastrin	Stimulates release of hydrochloric acid in stomach
	Cholecystokinin	Stimulates release of pancreatic secretions
	Secretin	Stimulates release of pancreatic enzymes, gallbladder contraction
Kidney	1,25-Dihydroxyvitamin D	Stimulates calcium absorption from the intestine
	Renin	Activates renin-angiotensin-aldosterone system
	Erythropoietin	Increases red blood cell production
Heart	Atrial natriuretic peptide (ANP)	Produces natriuresis
Ovaries	Estrogen	Affects development of female sex organs and secondary sex characteristics
	Progesterone	Influences menstrual cycle; stimulates growth of uterine wall; maintains pregnancy
	Inhibin	Inhibits FSH secretion by anterior pituitary
Testes	Androgens, mainly testosterone	Affect development of male sex organs and secondary sex characteristics; aid in sperm production
	Inhibin	Inhibits FSH secretion by anterior pituitary
Placenta	Human chorionic gonadotropin	Maintains pregnancy
Adipose cells	Leptin	Decreases appetite and food intake, increases sympathetic activity and metabolic rate, decreases insulin secretion to reduce fat storage
	Resistin	Suppresses insulin's ability to stimulate glucose uptake by adipose cells

Clinical Picture of Common Endocrine disorders



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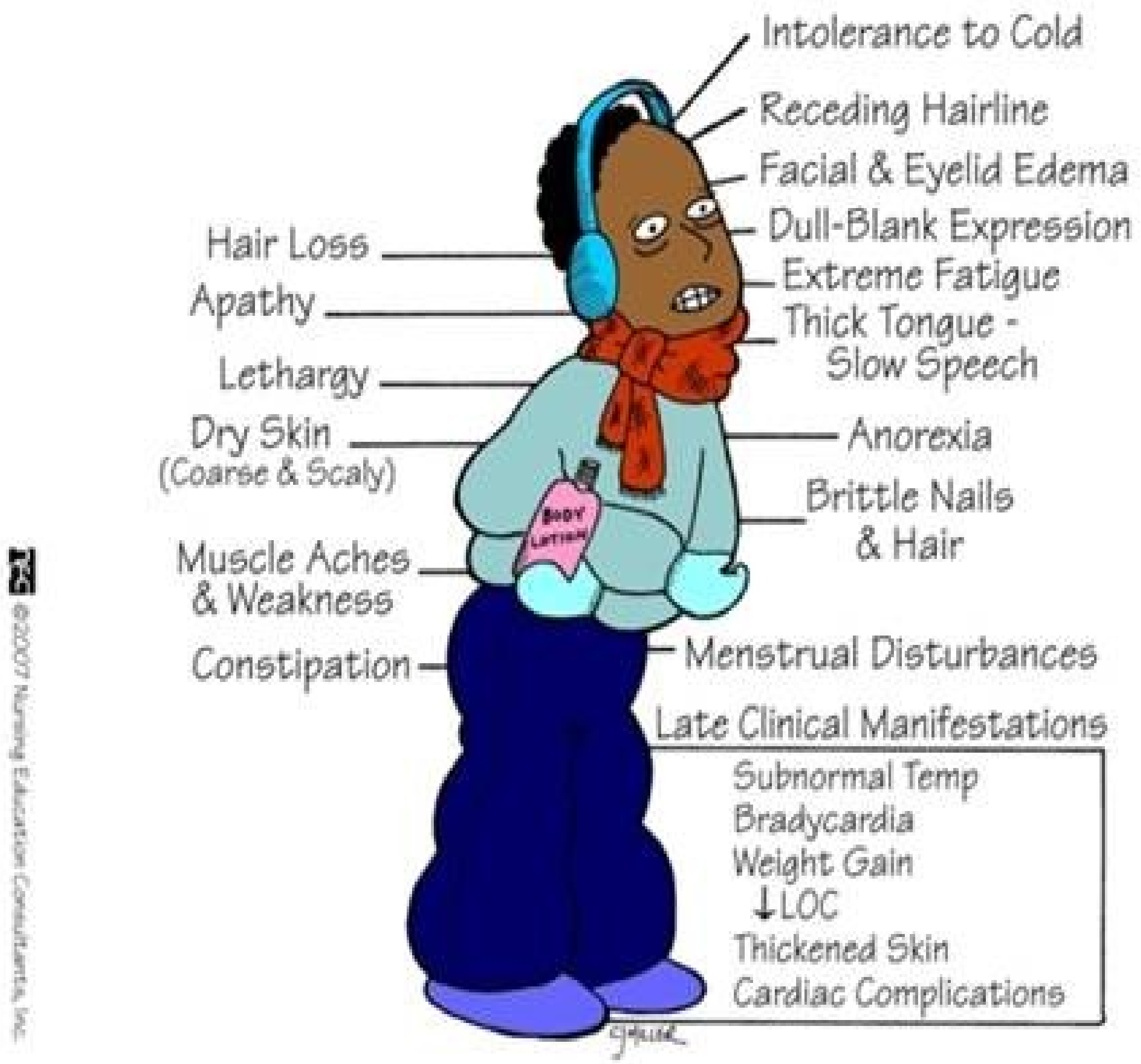
HYPOTHYROIDISM



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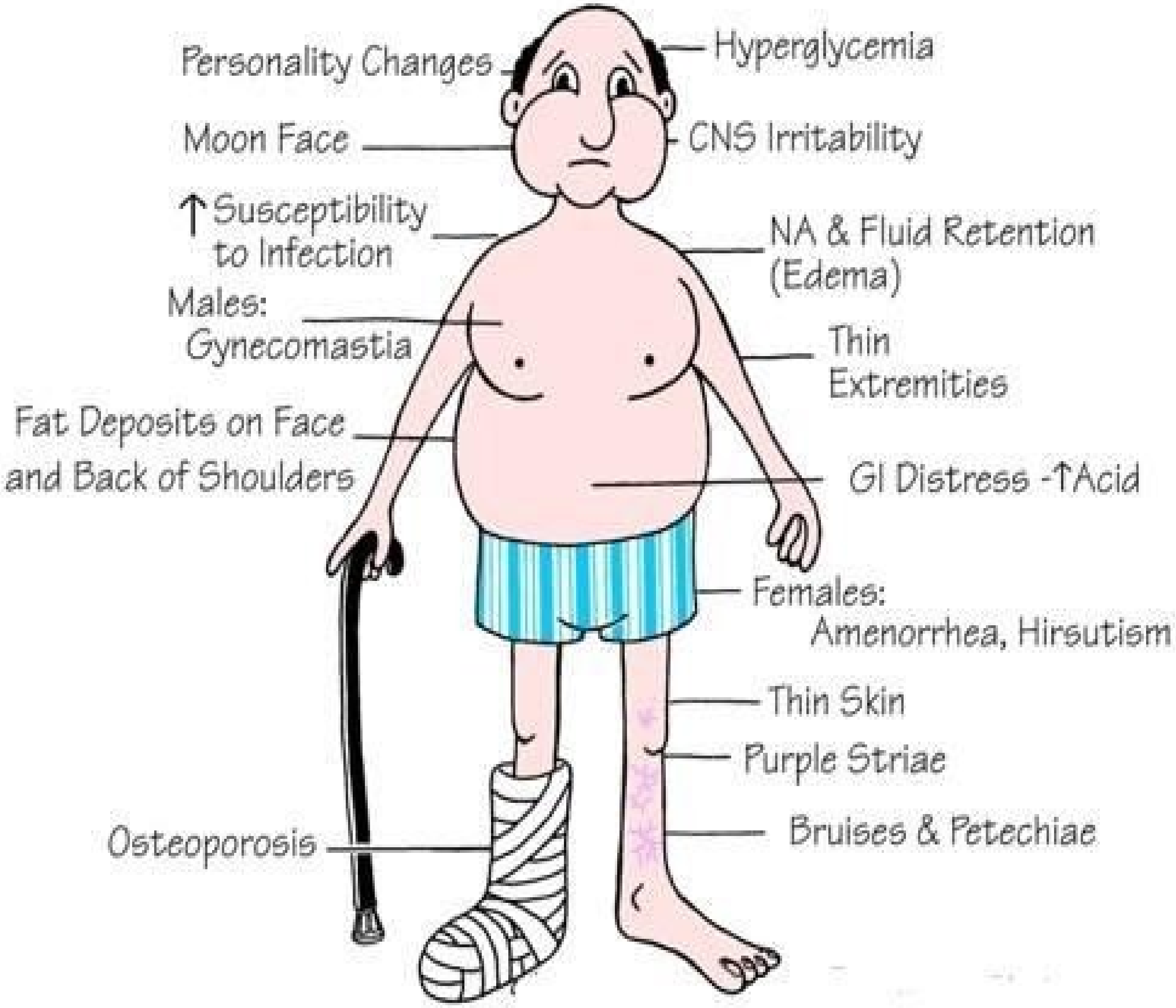
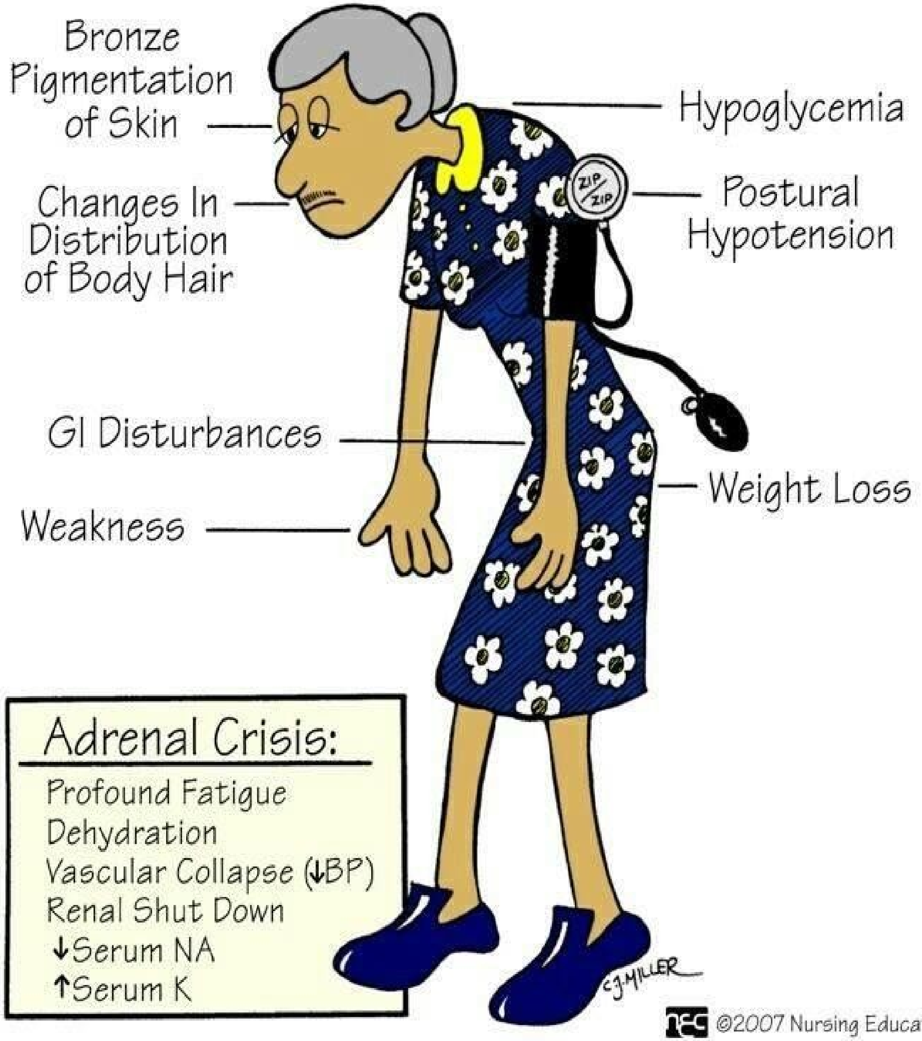
CUSHING'S SYNDROME



ADDISON'S DISEASE

Adrenocortical Insufficiency



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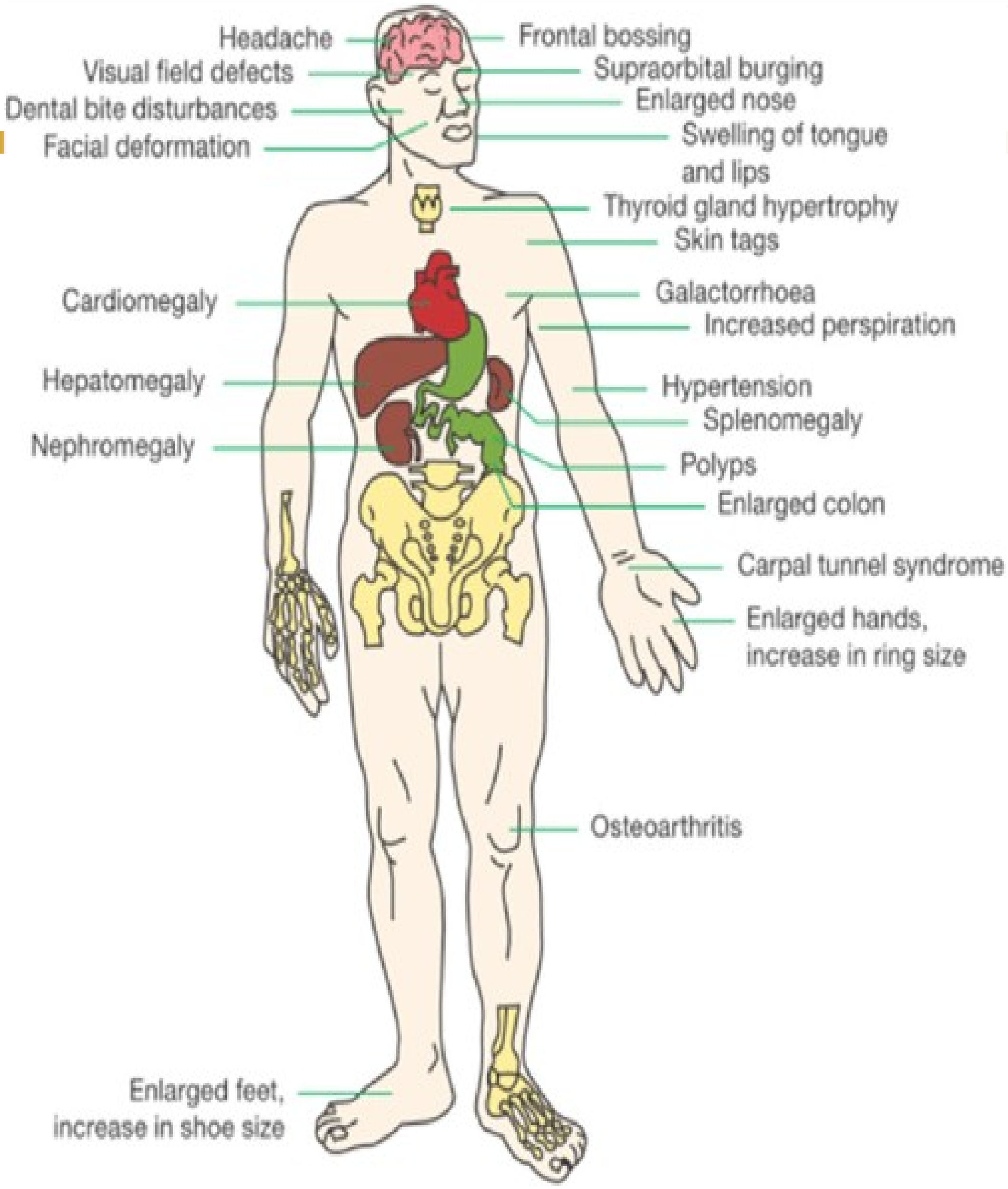
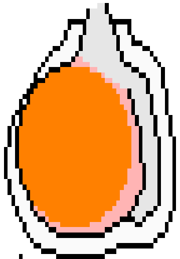
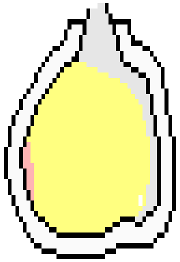
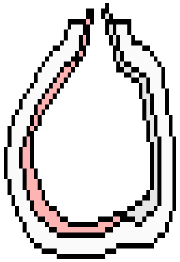

Headache
Visual field defects
Dental bite disturbances
Facial deformation
Frontal bossing
Supraorbital burging
Enlarged nose
Swelling of tongue and lips
Thyroid gland hypertrophy
Skin tags
Cardiomegaly
Galactorrhoea
Increased perspiration
Hepatomegaly
Hypertension
Splenomegaly
Nephromegaly
Polyps
Enlarged colon
Carpal tunnel syndrome
Enlarged hands, increase in ring size
Osteoarthritis
Enlarged feet, increase in shoe size

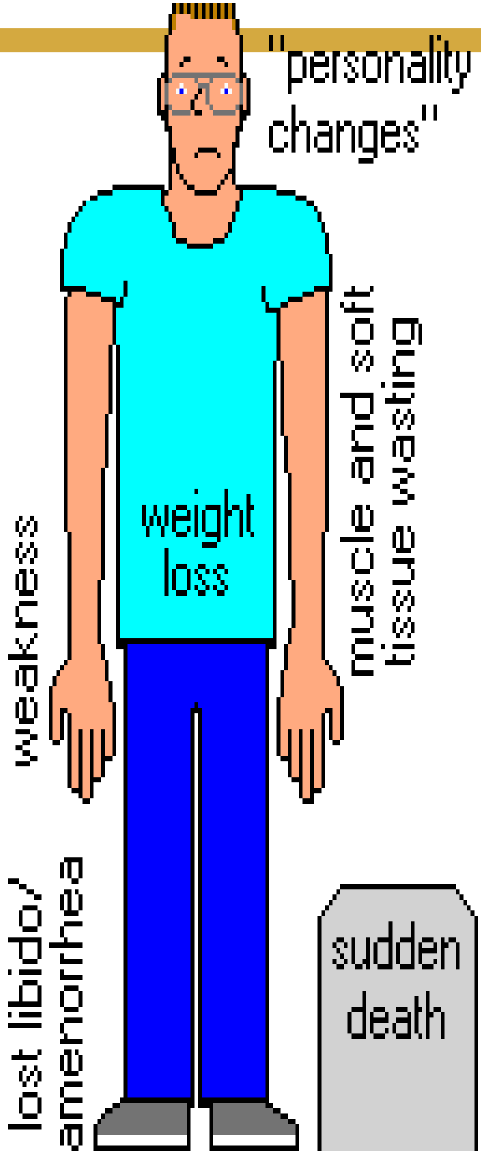
Hypopituitarism

Easy to diagnose and treat -- if you think of it.









Eventually:

All the problems of primary Addison's (except dark skin)

All the problems of primary hypothyroidism.

May also be present:
-- failure of lactation
-- diabetes insipidus
-- growth failure (kids)

Assessment. History

- **Demographic data**
  - Age and gender (some disorders are age related: hyperosmolar states, loss of ovarian function, decreased thyroid and parathyroid function; and gender related – sexual effects of hyperpituitarism and hypopituitarism)

Assessment. History

- **Personal and family history**
  - family history of obesity, growing or development difficulties, diabetes mellitus, infertility, or thyroid disorders
  - assess the patient of the following: endocrine dysfunction; signs or symptoms that could indicate an endocrine disorder; hospitalisations
  - past and current medications (hydrocortisone, levothyroxine, oral contraceptives, antihypertensive drugs)

Assessment. History

- **Diet history**
  - Nutritional changes and GI tract disturbances may reflect a variety of endocrine problems (nausea, vomiting, abdominal pain)
  - Changes in food and fluid intake (diabetes insipidus, diabetes mellitus)
  - Rapid changes in weight without accompanying changes in diet (diabetes mellitus, thyroid dysfunction)

Assessment. History

- Energy levels (changes in energy levels are associated with a number of endocrine problems: thyroid, adrenal glands)
- Elimination
  - urine amount and frequency. Does he or she urinate frequently in large amounts? Does the patient wake during the night to urinate (nocturia), or does he or she experience pain on urinaton (dysuria)?
  - information about the frequency of bowel movements and their consistency and color

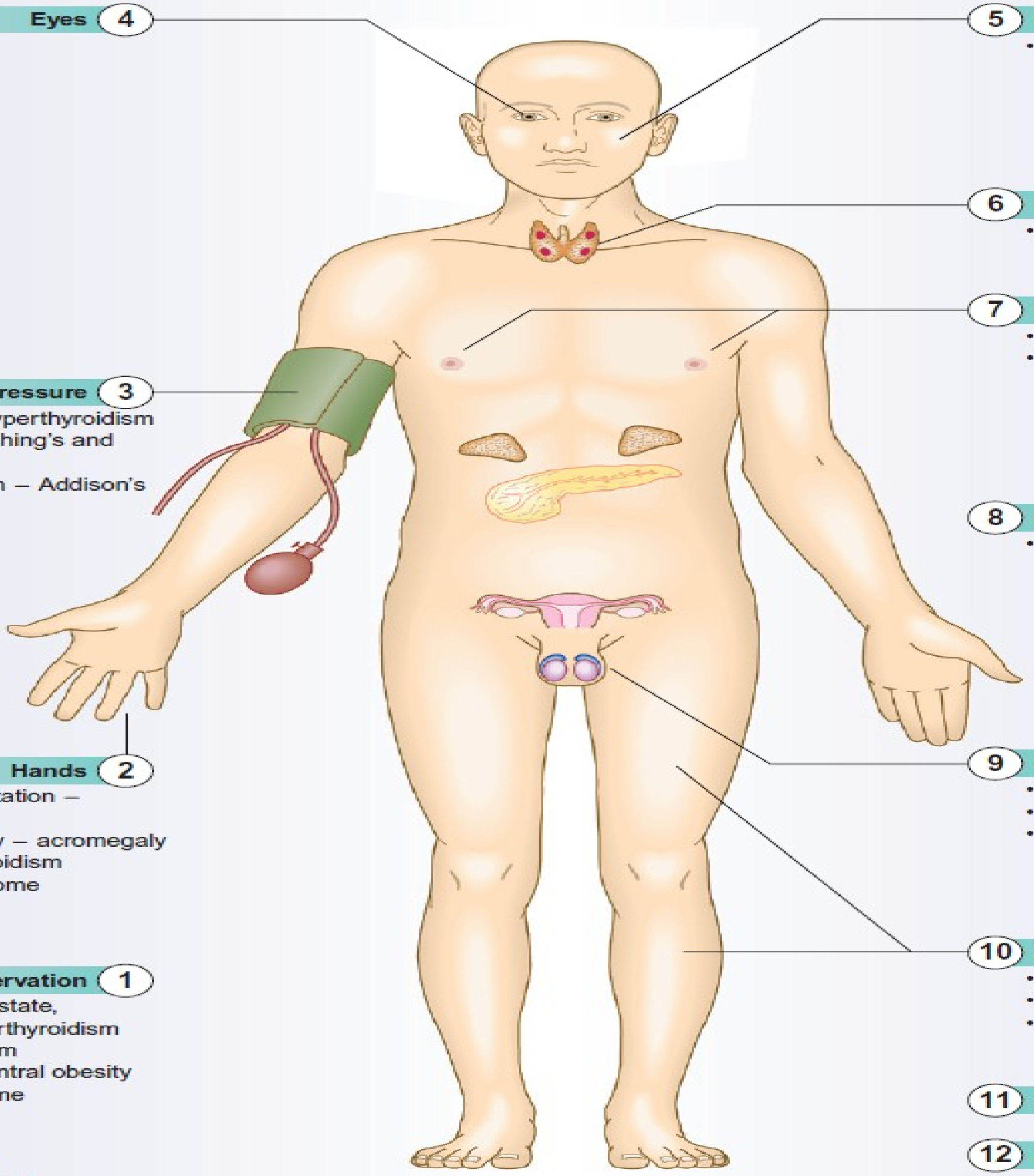
Assessment. History

- Sex and reproduction: Women are asked about any changes in the menstrual cycle (increased flow, duration, frequency of menses; pain or excessive cramping; or a recent change in the regularity of menses). Men are asked whether they have experienced impotence. Both have to be asked about changes in libido or any fertility problems

Assessment. History

- Physical appearance: The patient is asked about changes in the following:
  - hair texture and distribution
  - facial contours
  - voice quality
  - body proportions
  - secondary sexual characteristics

How To Examine The Endocrine System



1 General observation
- Demeanour, mental state,
  e.g. agitated – hyperthyroidism
  slow – hypothyroidism
- Appearance, e.g. central obesity in Cushing's syndrome
- Pallor
- Hair distribution,
  e.g. absent axillary,
  pubic – hypopituitarism
- Vitiligo
- Hirsutism

2 Hands
- Skin crease pigmentation – Addison's disease
- Large, sweaty, fleshy – acromegaly
- Tremor – hyperthyroidism
- Carpal tunnel syndrome
- Palmar erythema

3 Pulse and blood pressure
- Tachycardia/AF – hyperthyroidism
- Hypertension – Cushing's and Conn's syndromes
- Postural hypotension – Addison's disease

4 Eyes
- Exophthalmos
- Ophthalmoplegia
- Visual field defect

5 Face
- Features of
  Cushing's syndrome
  Addison's disease
  Acromegaly

6 Neck
- Goitre – smooth/nodular

7 Breasts
- Gynaecomastia
- Galactorrhoea

8 Bones
- Osteoporosis in hyperthyroidism, Cushing's syndrome and hypogonadism (loss of height, thoracic kyphosis)

9 Genitalia
- Virilisation
- Pubertal development
- Testicular volume

10 Legs
- Proximal myopathy
- Pretibial myxoedema
- Necrobiosis lipoidica

11 Height, weight, BMI

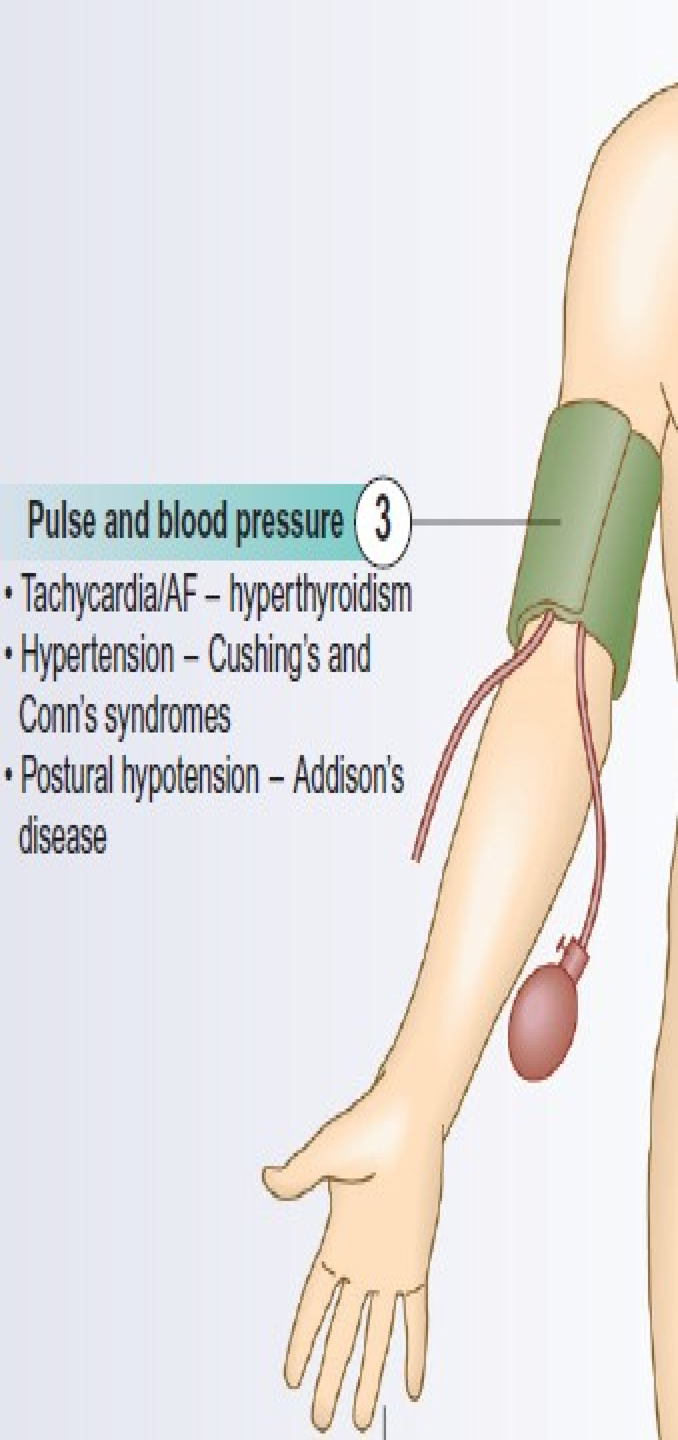
12 Urinalysis

13 Psychological/psychiatric assessment

Vital Signs

- **Pulse:** Rate – Rhythm- Volume (hyper and hypothyroidism)

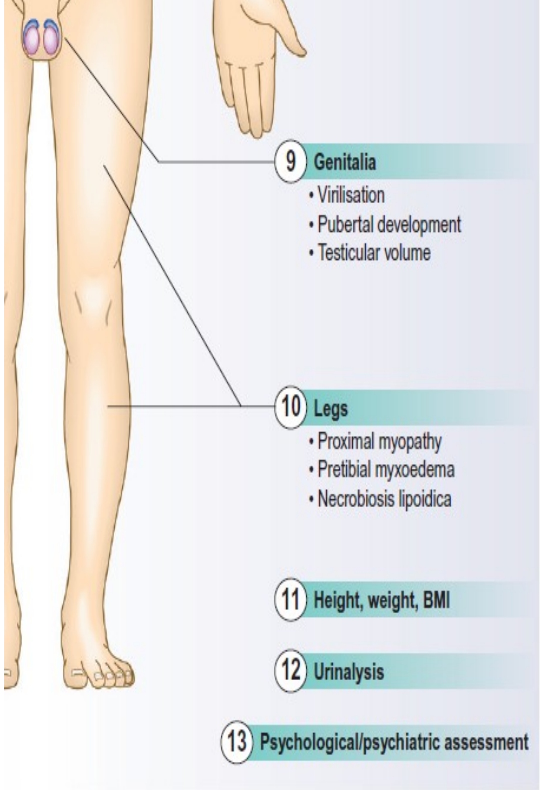
- **Blood pressure**
  - **Hypertension** (Cushing , hyper /hypo-thyroidism, pheochromocytoma, 1ry hyperaldosteronism),
  - **Hypotension** (Adrenal insufficiency)
  - **Postural hypotension** (adrenal failure, DM)
  - **Trousseau's sign (hypocalcemia)**



Pulse and blood pressure ③

- Tachycardia/AF – hyperthyroidism
- Hypertension – Cushing's and Conn's syndromes
- Postural hypotension – Addison's disease

Status and Patient Habitus



Height

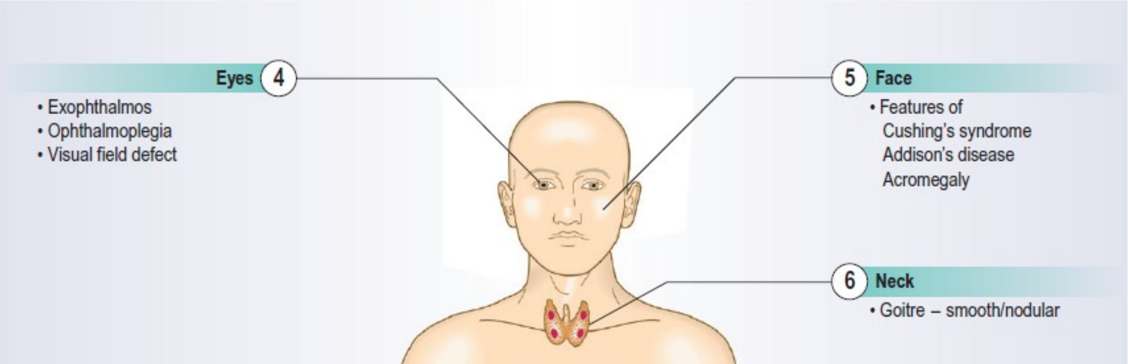
- **Short stature** (GH def, Turner’s syndrome,
- Achondroplasia, hypothyroidism, rickets)
- **Tall stature** (Gigantism,marfan syndrome, Androgen insensitivity syndrome, klinefelter syndrome)

Weight and BMI

- Weight gain (hypothyroid, PCO and metabolic syndrome, Cushing syndrome, insulinoma, Insulin therapy).
- Weight loss (hyperthyroidism,uncontrolled DM, adrenal failure, Zollinger Ellison syndrome, pheochromocytoma).
- Posture changes

Head and Neck

- Syndrome facies: (Cushing , hypothyroidism, facies of autoimmune hyperthyroidism, acromegaly).
- Acne, oily skin and hirsuitism (Cushing's, PCOs, hyper androgenic syndrome)
- Flushing (carcinoid, pheochromocytoma, post menopausal, hyperthyroidism)
- Goiter , lymph nodes, Web neck
- Jugular vein dilation – can indicate fluid overload
- Buffalo hump (Cushing’s syndrome)
- Supraclavicular fat pads (Cushing’s syndrome)



Skin and Hair

Eye

- **Proptosis and other eye signs** (grave’s ophthalmopathy disease)
- **Fundoscopic examination** for diabetic retinopathy, papiloedema
- **Visual fields**
- **extraocular muscle movements** :Limited eye movements in hyperthyroidism
- **Visual acuity disturbances** (DM, pituitary adenoma,)

Mouth and Pharynx

- **Hoarsness of voice** (hypothyroid,thyroid carcinoma acromegaly,)
- Look for pigmentation changes on buccal surfaces (Addison's).
- Tongue enlargement (acromegaly).
- **Tooth count:** if fewer than 20 teeth, consider osteoporosis

Chest, Abdomen and Pelvis

	klinefelter syndrome, hypopituitarism, Hypogonadism, hyperthyroid, aging, adrenal tumors
	pituitarism
	klinfelter syndrome, CAH, Cushing syndrome, hyperprolactinemia

Extremities - Hands

- Oversized hands of acromegaly
- Palmar erythema (hyperthyroid).
- Pigmentation of palmar crease (Addison's disease).
- Bradydactyly (shortened fingers)
- Shortened 4th and 5th can be seen in pseudohypoparathyroidism
- Nail changes
- **Tremor** (hyperthyroidism, hypercalcemia, hyperparathyroidism, hypomagnesemia, thiamin def, hypoglycemia)

Extremities – Arms / Axilla

Arms

- Muscle weakness (hypothyroidism)

Axilla

- Acanthosis nigricans (acromegaly).
- Axillary hair loss (hypopituitary).
- Skin tags (acromegaly).

Assessment of peripheral muscular weakness

- Brisk achilles and other reflexes in 25% of patients with hyperthyroidism

Auscultation

- Listen over thyroid for bruits and flow murmurs.
- Listen for bruits suggesting severe atherosclerosis in carotid, renal, femoral arteries
- Auscultate heart for evidence of cardiovascular disease which may be related to the endocrinal problem

Diagnostic Assessment

- **Laboratory tests**
  - Stimulation/suppression tests
  - Radioimmunoassay
  - Urine tests
  - Tests for glucose
- Radiographic examinations
- Other diagnostic tests (needle biopsy)

Thank You